

**550.1 DESCRIPTION**

This work consists of preparation of the existing bridge deck with approaches and the furnishing, handling, placing, curing, and finishing of the latex concrete or low slump dense concrete overlay.

**550.2 MATERIALS**

Materials shall conform to the following Sections:

**A. Cement:** Type I Cement, Section 750.

**B. Fine Aggregate:** Section 800.

**C. Coarse Aggregate:** Section 820.

**D. Water:** Section 790.

**E. Admixtures:** Sections 751 and 752.

**F. Curing:** Section 821.

**G. Latex Emulsion Admixture:** The latex admixture shall be a nonhazardous, film forming, polymeric emulsion in water. All stabilizers shall be added at the point of manufacture and shall be homogeneous and uniform in composition.

Physical properties: The latex admixture shall conform to the following requirements:

The latex admixture shall be styrene-butadiene polymeric emulsion containing 46 to 53 percent polymer. The polymer shall contain 60 to 70 percent styrene and 30 to 40 percent butadiene. The polymeric emulsion shall be stabilized with an anionic, nonionic surfactant and have a pH between 8.5 and 12.0.

The latex admixture shall be prequalified prior to use. A list of qualified products will be maintained by the Department.

The admixture selected or specified shall be certified to be of identical formulation to that submitted for prequalification testing. Along with the certification the supplier shall furnish the polymer percent of the total emulsion and pH of the formulation. Tests of latex admixture furnished shall meet these formulation values within the following tolerances:

Percent polymer of Total Emulsion.....±1.5%  
pH.....±1.0

The latex admixture shall be stored in enclosures, which protect the material from freezing and exposure to direct sunlight during periods when temperatures are in excess of 85° F (29° C). As a minimum, insulating blanket material shall be placed over both the tops and sides of drums stored at the work site. Storage at the work site shall not exceed 10 days.

**H. Grout Admixtures:** Grout admixtures shall be a one component acrylic bonding additive. The additive shall be one of the grout admixtures from the Approved Products List, or an approval equal as determined by the Office of Bridge Design.

550.3 CONSTRUCTION REQUIREMENTS

A. Quality and Proportioning:

1. **Latex Modified Concrete Mixture Design:** Latex modified concrete shall conform to the following mixture requirements:

MATERIAL OR PROPERTY	MIXTURE PROPORTIONS OR TEST LIMITS
Cement content	7.25 bags/cu.yd. (9.5 bags/m <sup>3</sup> )
Latex Emulsion Admixture	3.5 gal/bag (13.2 L/bag)
Water*	±2.5 gal/bag (±9.5 L/bag)
Water cement ratio*	0.40 max
Entrained Air	5.0% ±1.0%
Slump	4-8 in. (100-200 mm)
Fine Aggregate**	60%

\*The water added shall be adjusted to control the slump within specified test limits and produce a water cement ratio not to exceed 0.40 by weight. Forms DOT-84 and DOT-83 provide methods, which will be used to determine aggregate moisture and water/cement ratio. Only the coarse aggregate quantity shall be adjusted to compensate for changes in water quantity.

\*\*The initial aggregate weights shall be established by using specified mix proportions for cement, latex emulsion and water assuming five percent entrained air to determine volume available for total aggregate. Using actual specific gravity for the materials, determine the weights of coarse and fine aggregates by using 60 percent by weight fine aggregate.

2. **Low Slump Dense Concrete Mixture Design:** The low slump dense concrete mixture design shall conform to the following: Basic absolute volume per unit volume of concrete:

Coarse Aggregate	0.312088
Fine Aggregate	0.312088
Air	0.060000
Water	0.160255
Cement	<u>0.155569</u>
	1.000000

Approximate quantities of dry materials per cubic yard (cubic meter) of concrete:

Coarse Aggregate	1,394 lbs. (827 kilogram)
Fine Aggregate	1,394 lbs. (827 kilogram)
Cement	823 lbs.(488 kilogram)[8.75 bags]

These quantities are based on the following assumptions:

Specific gravity of cement	3.14
Specific gravity of aggregate	2.65

Actual specific gravities shall be used for adjustments in mix proportions.

An approved water reducing admixture for improving workability will be added in accordance with manufacturer recommendations. The slump when measured according to SD 404 (AASHTO T 199) shall be one inch (25 mm) maximum. The entrained air content of the freshly consolidated concrete, as determined by SD 403 (AASHTO T 152), shall be 6.0 percent with a tolerance of  $\pm 1.0$  percent.

Grout for bonding new concrete to old concrete shall consist of equal parts by weight of Portland cement and sand, mixed with sufficient water to form a thick slurry. A grout admixture shall be added to the grout mixture in accordance with the manufacturer's recommendations. The consistency of the slurry shall be such that it can be applied with a stiff brush or broom to the old concrete in a thin, even coating that will not run or puddle in low spots. For sealing vertical joints between adjacent areas of placement, grout shall be thinned to consistency of paint.

**B. Equipment:** Equipment for deck preparation, mixing, placing, and finishing of latex modified concrete or low slump dense concrete shall be approved prior to start of work.

**1. Surface Preparation:** Surface preparation equipment shall consist of the following:

- a. Power operated mechanical scarifier or grinder capable of removing at least 1/4 inch (6 mm) from the existing concrete surface in one pass.
- b. Concrete sawing equipment capable of sawing concrete to the specified depth.
- c. Power driven hand tools for concrete removal on the bridge deck will be limited by the following:
  - 1) Jack hammers heavier than 30 pound (14 kilograms) will not be permitted.
  - 2) Chipping hammers heavier than 15 pound (7 kilograms) will not be permitted to remove concrete beneath any reinforcing bar.
- d. Sand blasting equipment capable of removing rust and old concrete from exposed reinforcement and removing surface latence from new substrate concrete.

2. **Proportioning and Mixing:** Proportioning and mixing shall be by a self-contained, mobile continuous mixing unit, conforming to Section 460.3 F.
3. **Consolidation:** Consolidation equipment shall be internal vibration (spud vibrator) equipment.
4. **Placing and Finishing:** Placing and finishing equipment shall include hand tools for placement and brushing in freshly mixed modified concrete or grout. The hand tools shall be used to distribute the concrete to the correct level prior to striking off with the finishing machine.

The finishing machine shall be capable of forward and reverse motion under positive control and be capable of raising all screeds, cylinders, augers, and vibratory pan or pans to clear the surface when traveling in reverse. Modifications of the factory product will require approval.

Screed rails shall be capable of rigidly supporting the finishing machine without significant deflection and shall be securely fastened to their supports.

A portable lightweight or wheeled work bridge shall be required for use behind the finishing operation.

The finishing machine for latex modified concrete shall be a self-propelled rotating cylinder type, with one or more rotating steel cylinders, augers and variable frequency vibratory pans. The machine shall span the concrete placement width. The cylinders, augers, and vibratory pans shall be capable of placing and consolidating the concrete to the established profile by traversing the placement width, transverse to the roadway centerline.

The finishing machine for low slump dense concrete shall have a mechanical strike off to provide uniform thickness of concrete in front of an oscillating screed. The finishing machine shall have at least one oscillating screed capable of consolidating the concrete to the specified density. A sufficient number of identical vibrators shall be installed to provide at least one vibrator for each five foot (1.5 meters) of screed length. The bottom face of the screed shall be at least 5 inches (125 mm) in width with a turned up or rounded leading edge to minimize surface tearing. Each screed shall have an effective weight of at least 75 pounds (360 kilograms) per square foot (square meter) of bottom face area. Each screed shall be provided with position control of vertical position, tilt angle, and crown shape.

The finishing machine and appurtenant equipment shall provide positive machine screeding of the concrete within one inch (25 mm) of the face of existing curbs. The screed shall extend at least six inches (150 mm) beyond the line where a saw cut is intended to form the edge of a subsequently placed lane. The screed shall overlap the sawn edge of a previously placed adjacent lane by at least six inches (150 mm).

**C. Surface Preparation:****1. Concrete Removal:**

- a. Type 1A Removal shall consist of removing the surface of the existing concrete deck by machine scarifying. Areas designated for Type 1A Removal shall be scarified at least 1/4 inch (6 mm) in depth by a power operated scarifier or grinder. When specified, scarifying deeper than the 1/4 inch (6 mm) will be required.

The area around existing deck floor drains shall be hand chipped to a minimum depth of 3/4 inch (20 mm) to provide clearance for placement of a 3/4 inch (20 mm) minimum thickness of overlay tapered to meet the existing floor drain top in a nominal one foot (300 mm) radius.

For projects where the bridge deck overlay is placed in phases, it will not be permissible to accomplish Type 1A removal over the entire deck surface and then allow traffic on the scarified surface.

The mechanical scarifying operation shall be immediately suspended, if the scarifier contacts reinforcing steel, until the limits of the high reinforcing steel have been determined by the Engineer. A minimum depth of 1/4 inch (6 mm) of concrete surface shall be removed from the area of high reinforcing steel by hand chipping. Hand chipping removal in these areas will be measured and paid for under the item Type 1B Removal.

- b. Type 2A Removal areas will be determined after the Type 1A Removal has been accomplished. Type 2A Removal shall be the removal of relatively large areas of unsound existing overlay below the Type 1A Removal, using machine scarification equipment. After completion of the Type 1A Removal, the Engineer will inspect the deck and mark remaining areas of unsound concrete. Remaining unsound existing overlay shall be removed using machine scarification equipment when the unsound area is relatively large, as determined by the Engineer.

The Engineer will order the use of Type 2A Removal and will determine the required depth of pass or passes. The total depth of Type 2A Removal will not exceed 1 inch or the depth to the top mat of reinforcing steel, whichever is less.

Areas of unsound existing overlay that are not large enough to warrant the use of machine scarification equipment may be removed using Type 1B Removal, at the Engineer's discretion.

Extreme care shall be taken to avoid damaging the reinforcing steel with the scarification equipment during Type 2A Removal. Type 2A Removal shall stop in any area where reinforcing steel is encountered, until further direction by the Engineer. Reinforcing steel that is damaged during Type 2A Removal shall be repaired by the Contractor, as directed by the Engineer, and will be paid for as per Section 4.3. Reinforcing steel that is

damaged due to scarification below the depth specified by the Engineer shall be repaired by the Contractor, as directed by the Engineer, at no additional cost to the Department.

- c. Type 1B Removal areas will be determined after Type 1A Removal has been accomplished. Type 1B Removal shall consist of removing delaminated or unsound concrete by chipping or machine scarifying below the Type 1A Removal and extending down to the top of the top bar in the top mat of reinforcing steel. Concrete removed below the top of the top bar incidental to Type 1B Removal will be considered a part of the Type 1B Removal.
- d. Type 1C Removal areas will be determined after Type 1B Removal has been accomplished. Type 1C Removal shall consist of removing unsound concrete below the Type 1B Removal and above the top of the top bar of the bottom mat of reinforcing steel.

If Type 1C Removal extends down to the top of the top bar of the bottom mat, Type 1D Removal will be required regardless of the condition of the concrete remaining.

- e. Type 1D Removal shall consist of removing concrete below Type 1C Removal to the full depth of slab.

The edges of the resulting hole in the deck shall be nearly vertical or tapered inward from the top down. A reversed taper will not be permitted. The underside of the deck shall have a neat appearance. Feather edging of the concrete fill will not be permitted. Saw cutting the underside of the slab may be required if satisfactory results cannot be achieved by other means.

- f. Type B Removal shall consist of the removal of existing concrete from around the periphery of reinforcing bars. When Type 1A and Type 1B Removal has been accomplished in an area, the Engineer will determine the sections of reinforcing requiring Type B Removal. Normally, Type B Removal will be ordered when an isolated bar has lost bond on more than one-half of its circumference. On those sections the concrete shall be removed from around the periphery of the bar using chipping hammers and hand tools. A minimum clearance of 3/4 inch (20 mm) around the bar shall be provided. Care shall be exercised to prevent cutting, stretching, and damaging all exposed reinforcing steel.

Type 1C Removal may be ordered in lieu of Type B Removal if damage to sound concrete between bars is suspected or when deemed appropriate for other reasons.

- 1) When the extent or location of Type 1C and Type 1D Removal becomes critical to the structural integrity of the deck, the Bridge Program will be requested to make a determination. Shoring, when required, shall be accomplished under the provisions of Section 9.5.
- 2) **Backfill of Extra Depth Holes:** When Type 1C or 1D removal is necessary, the holes shall be backfilled as follows:

- a) Class A45 (A31) Concrete shall be used to fill extra depth removal holes up to the level of the surrounding prepared deck area. In lieu of using Class A45 concrete, the extra depth removal holes may be filled with the same mix used for low slump dense concrete provided the following properties apply:
  - 1. The concrete shall attain a minimum compressive strength of 4500 psi (31 MPa) in 28 days.
  - 2. The concrete shall contain 5.5 to 7.5 percent entrained air.
  - 3. The concrete slump shall be from 1" to 4 ½" (25 mm to 115 mm).
  - 4. The water-cement ratio shall not exceed 0.40.
- b) Concrete used to backfill extra depth holes shall be cured with a double layer of wet burlap or cotton mats and polyethylene sheeting until a minimum compressive strength of 2000 psi (14 MPa) has been attained. Curing compound shall not be used.

## 2. General:

- a. Exposed reinforcing steel shall be thoroughly cleaned by sandblasting to the satisfaction of the Engineer.
- b. Concrete adjacent to or within six feet (1.8 meters) of fresh placed overlay concrete shall not be scarified or chipped until the fresh overlay concrete has cured for a minimum of 96 hours.
- c. Jack hammers and mechanical chipping tools shall not be operated at an angle in excess of 45 degrees measured from the surface of the concrete, except in areas where Type 1D Removal is required.
- d. Reinforcing steel damaged during the concrete removal shall be repaired or replaced at the expense of the Contractor.
- e. Within 24 hours of placement of the overlay concrete, the deck surface shall be thoroughly cleaned of all loose or foreign material by sandblasting. The sandblasting shall be to an extent that all surface latence is removed. Sandblasting, of old decks being overlaid, shall expose the coarse aggregate and remove rust from exposed reinforcing steel.

If precipitation or any other contamination occurs on the deck surface within the 24 hour requirement, the deck surface shall be re-sandblasted and thoroughly cleaned.

After sandblasting, the surface shall be cleaned by air blast using a compressor equipped with a satisfactory operating filter.

If necessary to remove rust, oil, and other foreign materials detrimental to achieving bond, detergent cleaning, sandblasting, and air blast or vacuum will be required.

The edges of previously placed overlay and bottom of curb faces shall be sandblasted.

Immediately prior to placement of latex modified concrete, the clean surface shall be thoroughly wetted for a minimum of one hour. Standing water in depressions or holes shall be blown out with compressed air or removed by other acceptable means.

- f. The Contractor shall prevent spilling fuel and oil or bringing asphalt or other foreign materials onto the prepared deck. Equipment for use on the deck shall not leak fuel, oil, or drag foreign material onto the prepared deck.
- g. On low slump dense concrete overlays, before an adjacent course is placed, transverse and longitudinal joints of previously placed surface course shall be saw cut the full thickness of the overlay. The material shall then be removed back a minimum of six inches (150 mm) to provide a straight and vertical edge. At the abutment ends of the bridge, the saw cut shall be made directly over the existing joint as shown on the plans so as to minimize reflective cracking of the overlay. Concrete breakout shall be done using chipping hammers no heavier than 15 pounds. The previously placed surface course shall cure a minimum of 12 hours prior to sawing. If this work is started before the end of the 72 hour curing period, the work shall be restricted as follows:
  - 1) Sawing or other operations, which interfere with the curing, shall be kept to a minimum time and in the immediate work area.
  - 2) Curing shall be resumed promptly upon completion of the work.
  - 3) The exposed area shall be kept damp until the curing media is replaced.
  - 4) Power driven tools heavier than a 15 pound (7 kilogram) chipping hammer will not be permitted.

When bridge deck resurfacing is being performed on one-half of the width and traffic is carried on the other one-half of the deck, only the portion the deck being resurfaced shall be scarified. Traffic is not allowed on the scarified surface of the deck before it is resurfaced.

#### **D. Resurfacing Operation Limitations:**

1. **Latex Modified Concrete Limitations:** Under normal working conditions placement and finishing shall proceed at a rate of not less than 40 lineal feet (12 meters) per hour, measured parallel to the centerline of the bridge.

Latex modified concrete shall be between 45° F (7° C) and 80° F (27° C) at the time of placement and shall be maintained in this temperature range for at least 48 hours after placement. The concrete surface at the time of placement of the mixture shall be at least 40° F (4° C) as measured by a thermometer placed under an insulating blanket and laid against the surface. The latex modified concrete may not be placed after October 1 or before May 1, without written authorization. The latex modified concrete shall not be placed when the air



temperature in the shade exceeds 85° F (29° C). It may be necessary to place concrete during evening or early morning hours to comply with this requirement.

Traffic shall not be permitted on the latex mortar surface until 96 hours after placement. A longer curing period may be required when temperatures fall below 55° F (13° C).

Acceptable lighting shall be in place prior to surface preparation or concrete placement planned during hours of darkness.

A construction dam or bulkhead shall be installed when a delay in the placement operation exceeds one hour. During minor delays of less than one hour the end of the concrete may be protected from drying with several layers of wet burlap. Adequate precautions shall be taken to protect freshly placed concrete from sudden or unexpected rain. Placing operations shall stop when it starts to rain. Fresh concrete damaged by rainfall shall be removed.

After the bridge deck overlay has hardened, it shall be tested in accordance with 460.3.M.4.d.

- 2. Low Slump Dense Concrete Limitations:** Placement and finishing shall proceed at a rate of not less than 40 lineal feet (12 meters) per hour, measured parallel to the centerline of the bridge. Unless otherwise authorized, pours shall not exceed 24 feet (7.3 meters) in width.

Overlay placement shall not be delayed for a period exceeding 20 minutes. All exposed concrete shall be covered with wet burlap if placement operations are delayed. Placement operations shall cease if delay exceeds 20 minutes and placed concrete shall be removed to a point determined by the Engineer.

The existing surface at the time of concrete placement shall be at least 40° F (4° C), measured by a thermometer placed against the surface and covered with an insulating blanket. The concrete shall be at least 45° F (7° C) and 80° F (27° C) at the time of placement and shall be maintained at or above 45° F (7° C) for at least 72 hours.

Concrete placement will not be permitted after October 1 or before May 1 and when the air temperature is above 85° F (29° C) in the shade. It may be necessary to place concrete during evening or early morning hours and during periods of low humidity and high wind to comply with this requirement.

During periods of extreme and sustained hot weather, it may become extremely difficult to maintain the 80° F (27° C) maximum concrete temperature for low slump dense concrete. When such conditions exist, the Engineer may authorize the maximum concrete temperature to be increased to 85° F (29° C) provided that the concrete is placed when the ambient air temperature is below 80° F (27° C) and the following conditions are met.

- a. The coarse aggregate piles shall be flushed with cool water.
- b. The wet burlap shall be placed as soon as the concrete surface will support it without deformation.

- c. In an effort to keep the temperature of the water as cool as possible and minimize heating of the water due to warm weather, the water tank on the mobile mixer shall not be filled until immediately prior to the concrete placement, at which time the tank shall be filled with cold water. The addition of ice to the water will be allowed.

The placement of low slump dense concrete will not be allowed to begin when it is anticipated that the ambient temperature will exceed 80° F (27° C) at anytime during the duration of the concrete placement, unless the Contractor has approved fogging equipment on the project and ready for use. Fogging equipment shall be capable of applying a fine fog (water droplets no larger than 75 microns), not a spray, under pressure through an atomizing nozzle over the entire exposed concrete surface until such time that the wet burlap can be applied. The manufacturer's literature, equipment specifications and operating instructions for the fogging equipment shall be submitted to the Office of Bridge Design for approval prior to use. The fogging option will not be allowed when the wind conditions are such that the fog cannot be maintained over the exposed concrete surface.

Traffic will not be permitted on the completed surface for 72 hours after placement. A longer period of no traffic may be required when temperatures are below 55° F (13 C).

Acceptable lighting shall be in place prior to surface preparation or concrete placement planned during hours of darkness.

The Contractor shall avoid placing longitudinal joints in the traffic wheel paths. The location of longitudinal joints shall be subject to approval.

Concrete shall not be placed adjacent to a surface course less than 36 hours old. Continuation in the same lane from a transverse joint will be permitted after the concrete is 12 hours old.

**E. Proportioning and Mixing Concrete Materials:** Proportioning and mixing shall conform to Section 460.3.

**F. Placing, Finishing, and Curing:** Surfaces shall be completely cleaned and approved prior to placing concrete. If the mixing unit or any other piece of equipment is allowed on the prepared deck, that part of the deck which may come in contact with or be directly under the equipment shall be protected with clean polyethylene or other suitable material. Polyethylene sheeting or other suitable material is required on all areas in which concrete buggies or other equipment will be operated. Any concrete buggy or other equipment that has picked up dirt, debris, or other contaminants on the tires shall not be allowed on the bridge deck until properly cleaned.

Screed rails shall be placed and fastened in position to ensure finishing the new surface to the required profile.

When the overlay is being placed over a properly prepared surface of an existing structure, the longitudinal profile shall normally follow a smooth line which is a fixed distance above the original deck surface or "old concrete line" shown on the plans. The nominal thickness of the overlay above the scarified surface shall be as specified.

The transverse section shall conform to the section of the original deck surface.

If an overlay is placed over a newly constructed bridge deck, the longitudinal profile shall follow a smooth line, which is a fixed distance above the bridge deck surface. The nominal thickness of the overlay above the surface shall be as specified.

The mixture shall be placed and struck off to approximately 1/4 inch (6 mm) above final grade. The mixture shall then be consolidated and finished to final grade with the finishing machine. The finished surface shall meet the surface smoothness requirements for bridge deck surfaces specified in Section 460.3.M.4.d.

Hand finishing with a wood float may be required along the edge of the pour or on small repair areas. Edge tooling is required at joints, except next to metal expansion dams, curbs, and previously placed lanes.

On projects requiring repair or resurfacing of old bridge decks, the overlay material shall be consolidated with suitable spud vibrators in all areas where concrete has been removed below existing reinforcement.

The following additional requirements shall apply for each specific type of overlay.

- 1. Latex Modified Concrete Overlay:** Longitudinal construction joints in the overlay shall be located on the lane lines with no pour to be less than 24 feet (7.3 meters) wide.

The latex modified mixture shall be brushed onto the wetted prepared surface. All vertical and horizontal surfaces shall receive an even thorough coating. The rate of progress shall be limited so that the brushed material does not become dry before it is overlaid. All remaining latex modified brushing material, after the brushing process is complete, shall be disposed of as directed.

When a tight, uniform surface has been achieved, and before the plastic film forms, the surface shall be given a transverse metal-tine finish. The metal-tine finish shall provide a groove width of 1/8 inch and a groove depth of 3/16 inch (5mm)  $\pm$  1/16 inch (2 mm). The spacing between the individual tines shall meet the following:

Inches (ten foot tining rake)

2-5/16,	2-15/16,	1-1/4,	2-7/16,	2-1/16,	1-1/4,	13/16,	1,	1-5/16,	1-1/8,	2-5/16,
2-1/2,	2-7/8,	2-3/4,	1-1/8,	2-3/4,	2-1/8,	1-15/16,	13/16,	7/8,	2-5/8,	3-1/16
3-1/16,	7/8,	9/16,	9/16,	1-5/8,	2-3/8,	1,	1-1/4,	1-9/16,	2-15/16,	1-1/8
1-15/16,	2-3/16,	2,	2-13/16,	1,	2-11/16,	13/16,	1-7/8,	9/16,	2-5/16,	1-7/8
2-1/2,	1-5/16,	3-3/16,	1-3/8,	15/16,	7/8,	1-5/8,	9/16,	1-3/4,	2-7/8	3
1-5/8,	1-5/8,	7/8,	9/16,	5/8,	2-13/16,	1-5/8,	2-7/16,	13/16,	1-1/4,	11/16
2-3/4,	2-5/16,	1-1/8								

Millimeters (3 meter tining rake)

58,	74,	31,	62,	53,	32,	21,	26,	33,	28,	59
64,	73,	70,	29,	70,	54,	49,	20,	22,	67,	78
77,	23,	15,	15,	41,	60,	25,	32,	39,	75,	28
50,	55,	51,	72,	25,	69,	21,	47,	15,	59,	47
64,	34,	55,	35,	24,	22,	42,	14,	45,	73,	76
41,	41,	22,	15,	16,	71,	41,	62,	21,	31,	17
70,	58,	29								

Successive passes of the tining shall not overlap.

The screed rails and construction bulkheads shall be separated from the newly placed material by passing a pointing trowel along their inside face. Metal expansion dams shall not be separated from the overlay. Care shall be exercised to ensure that this trowel cut is made for the entire depth and length of rails or bulkheads after the mixture has stiffened sufficiently. In lieu of separation by pointing trowel, bulkheads with inside surfaces covered with a material that prevents bonding to the concrete may be utilized when approved.

The surface shall be covered with a double layer of clean wet burlap as soon as the surface can support the burlap without deformation. Within one hour of covering with wet burlap, a layer of four mil (0.10 mm) minimum thick polyethylene film shall be placed on the wet burlap and the surface cured for 48 hours. The curing material shall then be removed for an additional 48 hour air cure.

Combination burlap-polyethylene sheets may be substituted for one layer of burlap and the polyethylene film with the Engineer's approval.

2. **Low Slump Dense Concrete Overlay:** The grout shall be applied on a dry surface immediately before concrete placement. The thin coating of grout shall be scrubbed into the surface, abutting curb faces, and the vertical surface of previously placed lanes. The area to receive the overlay shall receive an even thorough grout coating. Care shall be taken to ensure that excess grout does not collect in pockets and that the rate of application is limited to an amount that will be covered with concrete before it dries.

The low slump dense concrete overlay shall be mechanically consolidated to 98 percent of the rodded unit weight determined in accordance with ASTM C138 and finished to final grade. Hand finishing with a float may be required to provide a tight, uniform surface. Internal vibration (spud vibrators) shall be used to consolidate the concrete along the abutment ends of the bridge, longitudinal edges, curb lines, and for any areas in which the overlay thickness is greater than three inches (75 mm).

As soon as finishing has been completed, all vertical joints with adjacent concrete shall be sealed by painting with thinned grout and the deck surface given a broomed and transverse metal-tine finish. The metal-tine finish shall provide a groove width of 1/8 inch and a groove depth of 3/16 inch (5 mm)  $\pm$  1/16 inch (2 mm). The spacing between the individual tines shall conform to Section 550.3.F.1.

Successive passes of the tining shall not overlap.

After the joint painting brooming and grooving is completed, the surface shall be promptly covered with a double layer of clean wet burlap. Care shall be taken to ensure that the burlap is well drained and that it is placed as soon as the surface will support it without deformation.

The surface shall receive a wet burlap cure for at least 72 hours. For the first 24 hours, the burlap shall be kept continuously wet by means of an automatic sprinkling or wetting system. Care shall be taken to ensure free water does not migrate into fresh concrete. After 24 hours, the Contractor may cover the wet burlap with a layer of polyethylene film for a minimum of 48 hours in lieu of using a sprinkling or wetting system.

The concrete shall be screeded and finished within 30 minutes of being placed on the deck. The Contractor will have an additional 15 minutes after the concrete has been finished to apply wet burlap. Failure to comply with these requirements shall be cause for rejecting the work. Surface concrete in all rejected areas shall be removed and replaced.

Combination burlap-polyethylene sheets may be substituted for one layer of burlap and the polyethylene film with the Engineer's approval.

After the bridge deck overlay has hardened, it shall be tested in accordance with 460.3.M.4.d.

**G.** After the curing period, the Engineer will chain drag the entire surface of the new bridge deck overlay to check for any areas that are not bonded to the substrate. Any areas that are not bonded to the substrate shall be repaired in the accordance with the following:

1. The entire perimeter of the unbonded area shall be sawcut the full depth of the overlay.
2. Concrete breakout shall be done using chipping hammers no heavier than 15 pounds.
3. The exposed surfaces, including the vertical faces, of the breakout area shall be thoroughly cleaned by abrasive blast cleaning.
4. The exposed surfaces, including the vertical faces, of the breakout area shall be coated with an approved bonding agent in accordance with the manufacturer's recommendations immediately prior to concrete placement.
5. Low Slump Dense Concrete shall be placed in the breakout areas within 24 hours of abrasive blast cleaning. In the event that the breakout area is contaminated with rain, dirt, debris or other contaminants before concrete is placed, the area shall be re-cleaned prior to concrete placement.
6. The concrete shall be cured with wet burlap and polyethylene sheeting for at least 72 hours.

Bridge deck overlay repair, including traffic control measures, shall be accomplished at no additional cost to the Department.

#### **550.4 METHOD OF MEASUREMENT**

- A. **Type 1A Removal:** Type 1A removal will be measured to the nearest 0.1 foot (10 mm) and the area computed to the nearest 0.1 square yard (0.1 square meter).
- B. **Type 2A Removal:** Type 2A Removal will be measured to the nearest 0.1 foot (10 mm) and the area computed to the nearest 0.1 square yard (0.1 square meter), irrespective of the areas measured as Type 1A Removal.
- C. **Type 1B Removal:** Type 1B removal will be measured to the nearest 0.1 foot (10 mm) and the area computed to the nearest 0.1 square yard (0.1 square meter), irrespective of the areas measured as Type 1A Removal.
- D. **Type 1C Removal:** Type 1C removal will be measured to the nearest 0.1 foot (10 mm) and the area computed to the nearest 0.1 square yard (0.1 square meter), irrespective of the areas measured for Type 1A and 1B Removal.
- E. **Type 1D Removal:** Type 1D removal will be measured to the nearest 0.1 foot (10 mm) and the area computed to the nearest 0.1 square yard (0.1 square meter), irrespective of the areas measured for Type 1A, Type 1B, and Type 1C Removal.
- F. **Type B Removal:** Type B removal will be measured to the nearest 0.1 foot (10 mm), irrespective of measurement for other types of removal.
- G. **Class A45 (A31) Concrete Fill:** Class A45 (A31) concrete fill will be measured to the nearest 0.1 cubic yard (0.1 cubic meter) as determined from the theoretical yield of the design mix and documented by the ticket batch printouts. If ticket printouts are not used, the Engineer may use cross section measure or net truck weight to determine theoretical volume based upon 150 pounds per cubic foot (2400 kilograms per cubic meter). When cross section measure is used, the methods of survey and computations shall be agreed to prior to the pour.
- H. **Latex Modified Bridge Deck Overlay:** Latex modified bridge deck overlay will be measured to the nearest cubic yard (cubic meter) as determined from the theoretical yield of the design mix and documented by the batch ticket printouts of the cement used and the yield tests performed. Deductions will not be made for aggregate thrown out due to brushing operations or material wasted in finishing operations, unless such waste becomes excessive. Material wasted or rejected due to other causes will not be included for payment.
- I. **Low Slump Dense Concrete Bridge Deck Overlay:** Low slump dense concrete bridge deck overlay will be measured to the nearest cubic yard (cubic meter) of concrete placed. Measurement of concrete produced will be determined from the documented amount of cement used, as shown by the mixer cement meter readings and supported by yield tests. Deductions will not be made for material wasted in the finishing operations and removed to form longitudinal joints, unless the waste becomes excessive. Concrete wasted or rejected for other causes will not be included for payment.

- J. Finishing and Curing:** Finishing and curing will be computed to the nearest 0.1 square yard (0.1 square meter). The actual area finished and cured will be measured to the nearest 0.1 foot (10 mm), exclusive of areas of metal expansion dams exposed in the finished surface.

#### 550.5 BASIS OF PAYMENT

- A. Type 1A Removal:** Type 1A removal will be paid for at the contract unit price per square yard (square meter). Payment will be full compensation for removal to the depth specified, required sawing, cleaning, hand removal around deck floor drains, disposal of removed material, labor, equipment, materials, and all incidental work required.
- B. Type 2A Removal:** Type 2A Removal will be paid for at the contract unit price per square yard (square meter). Payment will be full compensation for the removal performed with each pass of the scarification equipment to the depth directed by the Engineer. Payment will also include full compensation for any required cleaning, hand removal around deck drains, disposal of removed material, labor, equipment, and all incidental work required.
- C. Type 1B Removal:** Type 1B removal will be paid for at the contract unit price per square yard (square meter). Payment will be full compensation for removal of the specified concrete, required sawing, cleaning, disposal of removed material, labor, equipment, materials, and all incidental work required.
- D. Type 1C Removal:** Type 1C removal will be paid for at the contract unit price per square yard (square meter). Payment will be full compensation for the specified concrete removal, sandblasting, cleaning, disposal of removed material, labor, equipment, materials, and all incidental work required. If the actual ordered quantity exceeds plans quantity, the Department will advise the Contractor, prior to the accomplishment of this additional Type 1C Removal, whether payment will be made under the contract item, by negotiated prices or under the provisions of Section 9.5.
- E. Type 1D Removal:** Type 1D removal will be paid for at the contract unit price per square yard (square meter). Payment will be full compensation for the specified concrete removal, sawing, sandblasting, cleaning, forming, disposal of removed material, labor, equipment, materials, and all incidental work required. If the actual ordered quantity exceeds plans quantity, the Department will advise the Contractor, prior to the accomplishment of this additional Type 1D Removal, whether payment will be made under the contract item, by negotiated prices or under the provisions of Section 9.5.
- F. Type B Removal:** Type B removal will be paid for at the contract unit price per foot (meter). Payment will be full compensation for the specified concrete removal, sandblasting, disposal of removed material, labor, equipment, materials, and all incidental work required. If the actual ordered quantity exceeds plans quantity by more than 25 percent, the Department will advise the Contractor, prior to the accomplishment of this additional Type B Removal, whether payment will be made under the contract item, by negotiated prices or under the provisions of Section 9.5.

- G. Class A45 (A31) Concrete Fill:** Class A45 (A31) concrete fill will be paid for at the contract unit price per cubic yard (cubic meter). Payment will be full compensation for materials, labor, equipment, and all incidental work required.
- H. Latex Modified Bridge Deck Overlay:** Latex modified bridge deck overlay will be paid for at the contract unit price per cubic yard (cubic meter). Payment will be full compensation for labor, equipment, materials, and all incidental work required.
- I. Low Slump Dense Concrete Bridge Deck Overlay:** Low slump dense concrete bridge deck overlay will be paid for at the contract unit price per cubic yard (cubic meter). Payment will be full compensation for labor, equipment, materials, and all incidental work required.
- J. Finishing and Curing:** Finishing and curing will be paid for at the contract unit price per square yard (square meter). Payment will be full compensation for labor, equipment, materials, and all incidental work required.